

AMENDMENT AND RESPONSE UNDER 37 CFR § 1.111

Serial Number: 10/003,238

Filing Date: October 26, 2001

Title: ELECTRONIC ASSEMBLIES WITH FILLED NO-FLOW UNDERFILL (As Amended)

Assignee: Intel Corporation

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Thus, Applicants respectfully request that the Examiner consider the "Declaration Under 37 C.F.R. §1.131" and notify Applicants of his decision concerning such Declaration in the next official communication to Applicants.

Amendments to the Specification

Applicants have amended the paragraph beginning on page 8, line 24 by inserting the sentence "In an embodiment, the particles 116 are distributed substantially uniformly throughout the underfill 116". Support for this amendment may be found, for example, in FIGS. 5-7 of the application as originally filed. In addition, the phrase "an embodiment" has been substituted for "one embodiment", and the phrase "consisting of" has been substituted for "comprising".

No new matter has been added by way of these amendments to the specification.

Amendments to Claims 22, 27, 37, and 48

Each of independent claims 22, 27, 37, and 48 has been amended by adding the limitation "wherein the particles are distributed substantially uniformly throughout the underfill" [or "underfill material"]. Support may be found for this language in the paragraph beginning at line 24 of page 8, as amended. No new matter has been introduced.

Rejection of Claims 22-29, 35-40 and 46-51

under 35 U.S.C. §102(e)

as Anticipated by Hoang

Claims 22-29, 35-40 and 46-51 were rejected under 35 U.S.C. §102(e) as being anticipated by Hoang et al (U.S. 6,373,142). Applicants do not admit that Hoang is prior art and reserve the right to swear behind Hoang as provided for under 37 C.F.R. §1.131.

Hoang discloses a semiconductor chip package and a method of assembly wherein the concentration of filler material within underfill material between the chip and the package substrate varies from location to location within the underfill material (See Abstract and FIGS. 2A-6).

It is noted that Hoang also discloses a chip package in which the filler material within the flowable underfill appears distributed substantially uniformly throughout the underfill (FIG. 1B).

However, the flowable underfill is applied to this package after bonding the chip to the substrate (see col. 1, lines 60-64). Because the underfill is applied after the bonding operation, it is an attribute of that process that there is no possibility of any potentially inhibiting particles remaining between corresponding terminals and pads. While that attribute in itself may be desirable, because no particles will inhibit satisfactory bonding between the terminals and pads, using a flowable underfill containing a filler material may result in reliability problems for other reasons, such as reduced flow rate of underfill beneath the chip, resulting in voids. See, for example, col. 2, lines 33-39 of Hoang.

In contrast to the process used to produce the structure shown in FIG. 1B of Hoang, it is an attribute of Applicants' process that some relatively small potentially inhibiting particles may remain between corresponding terminals and pads, but relatively large potentially inhibiting particles are squeezed out, enabling a satisfactory bond to be made between the terminals and pads.

Applicants' disclosure, page 11, beginning line 4 states:

Covert
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Claim

It may not be essential to squeeze out every particle 122, depending upon the size and shape of particles 122. It is possible that one or more particles 122 may become embedded in one of bumps 132 and/or its corresponding pad 112 without unduly preventing adequate physical and electrical contact after solder join. However, suitable pressure is applied to cause bumps 132 to physically contact pads 112, so that during a subsequent solder reflow operation bumps 132 and pads 112 will be in adequate electrical contact.

The rule under 35 U.S.C. §102 is well settled that "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2D 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). MPEP §2131.

Regarding independent claims 22, 27, 37, and 48, Hoang's no-flow underfill embodiments (FIGS. 2A-6) fail to disclose the limitation that the particles are distributed substantially uniformly throughout the underfill material.

Further, Hoang's flowable underfill embodiment (FIGS. 1A-1B) fails to disclose the limitation "remove [or squeeze out] substantially all potentially inhibiting particles from between corresponding terminals and pads" in independent claims 22, 27, and 48, which limitation

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implies that one or more particles may remain between the terminals and pads. Independent claim 37 recites that "any particles remaining in the connections are of such size and shape that they do not prevent adequate physical and electrical contact between corresponding terminals and pads".

For the above reasons, independent claims 22, 27, 37, and 48 should be found to be allowable over Hoang, and Applicants respectfully request that the rejection of independent claims 22, 27, 37, and 48 under 35 U.S.C. §102(e) as anticipated by Hoang be withdrawn.

The claims that depend from independent claims 22, 27, 37, and 48 are also asserted to be allowable for the reasons presented above.

**Rejection of Claim 52 under 35 U.S.C. §103(a)
as Unpatentable over Hoang**

Claim 52 was rejected under 35 U.S.C. §103(a) as being unpatentable over Hoang.

Independent claim 48 is asserted to be patentable for the reasons presented above.

If an independent claim is nonobvious under 35 U.S.C. §103, then any claim depending therefrom is nonobvious. MPEP §2143.03.

Thus claim 52, which depends from claim 48 and incorporates all of the limitations therein, is also asserted to be allowable for the reasons presented above, and Applicants respectfully request that the rejection of claim 52 under 35 U.S.C. §103(a) as being unpatentable over Hoang should be withdrawn.

Additional Elements and Limitations

Applicants consider additional elements and limitations of claims 22-29, 35-40, and 46-52 to further distinguish over the cited references, and Applicants reserve the right to present arguments to this effect at a later date.

Documents Cited But Not Relied Upon For This Office Action

Applicants need not respond to the assertion of pertinence stated for the references cited but not relied upon by the Office Action, because these references are not made part of the

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rejections in this Office Action. Applicants are expressly not admitting to this assertion and reserve the right to address the assertion should it form part of future rejections.

Conclusion

Applicants respectfully submit that claims 22-29, 35-40, and 46-52 are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicants' attorney, Walter W. Nielsen (located in Phoenix, Arizona) at (602) 298-8920, or the below-signed attorney (located in Minneapolis, Minnesota) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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By their Representatives,

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Date July 12, 2004 By Ann M. McCrackin
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Reg. No. 42,858

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 12 day of July, 2004.

Name

KACIA LEE

Signature

Kacia Lee